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ASTRONOMICAL RESEARCH IN INDIA: I

ASTRONOMY is the oldest of the natural sciences, its beginnings being traceable to the remotest periods of recorded human history. There is ample indication in ancient Sanskrit literature of the interest with which the subject was studied in India from the earliest times, while the later writings of Aryabhatta, Varahamihira, Brahmagupta and of Bhaskaracharya, which have come down to us, show that astronomy was actively studied in India at a time when the lamp of learning lighted by the ancient Greeks had burnt out, and Europe was passing through the dark ages. The vicissitudes of Indian history in the later centuries of the present millennium were not favourable to the development and expansion of cultural interests. Some indication that active interest in astronomy nevertheless did not altogether disappear in India is furnished by the astronomical instruments of an earlier era which have been preserved to us, and by the curious structures known as Jaisingh's observatories which are still to be seen at Delhi, Benares and Jaipur.

During the three hundred and odd years which have elapsed since Galileo first directed his little telescope towards the heavens, the progress of astronomical science has been of the most spectacular character. This progress has largely been the result of the success achieved in making bigger and better telescopes. A study of the fascinating autobiography of John A. Brashear—the American who loved the stars and made great telescopes for observing them—may be warmly recommended to any one who is interested in the development of astronomical research in India. It brings home to the reader the extent to which the progress of astronomical science in a country depends on the existence in it of skilled opticians who can grind, polish and figure great lenses and mirrors up to the most exacting requirements. Without telescopes, interest in astronomy must languish, and without an active interest in astronomy, there obviously can be no telescopes in a country. That was the vicious circle which Brashear sought to break in a spirit of genuine altruism. The immense interest in astronomical science and the generous support accorded to it by wealthy men in the United States of America must, to no small extent, be credited to the influence of Brashear's life and work. The making of great lenses and mirrors is practical optics on an engineering scale, and it is no accident that Brashear was a mechanical engineer before he became a maker of telescopes. The mounting and driving of telescopes is also mechanical engineering of a very exacting nature. In a modern observatory, the ton-loads of material making the telescope and its accessories move with the same accuracy and smoothness as the hands of a wrist-watch go round its dial. Optics and engineering are the handmaids of observational astronomy without whose services she cannot live and flourish.

It may be asked, why trouble about astronomy? Why spend money on making great telescopes and building great observatories? These are pertinent questions to which it is the purpose of this article to return an answer. My reply would be that an interest in astronomy is a part of the cultural heritage of India, and that we would be unworthy recipients of that heritage if we did not cherish that interest and do our utmost to promote the science. As has been truly said, man does not live by bread alone. Astronomy is not only the oldest but the grandest of the sciences. The interest which it evokes in all thinking and cultured minds is instinctive—an expression of man's desire to understand and comprehend the universe he lives in. Modern science is accused—perhaps not unjustly—of allying herself with powers of destruction and helping to make death-dealing weapons of all kinds. I do not know, however, of anyone who has had the hardihood of including the science of astronomy in such an indictment. Like all other sciences, astronomy is not without some practical applications—such as time-keeping and aid to navigation at sea—which have given it claims to support from public funds. But the real purpose of astronomy is very remote from such applications. Broadly, it may be described as the investigation of the nature of the physical universe. Defined in that way, we begin to realize that astronomy occupies the premier position amongst the sciences. Indeed, it may be described as a heaven-born river of knowledge which flows to the earth and fertilizes the fields of learning and culture. That this view of astronomy is fully justified will be evident to any one who makes a comprehensive survey of the history of modern science during the past three hundred years.

As some of the outstanding results of astronomical research which have influenced the orientation of scientific thought, we may mention the discovery of the finite velocity of light by Romer, of aberration by Bradley, of the laws of planetary motion by Kepler, of the dark lines in stellar spectra by Fraunhofer, of helium in the sun by Lockyer, of the magnetic field in sunspots by Hale, and of the recession of the nebulæ by Hubble. When we examine the structures of modern physical and chemical thought, we find that they are laid on foundations built out of the results of observational astronomy. *Vice versa*, observational astronomy calls to its aid all the resources of the experimental physicist, while astronomical thought and speculation have as their basis the well-established laws of experimental physics and chemistry.

It will be evident from what has been said that the organization of scientific research in India must be considered radically defective unless and until adequate provision is made for astronomical study and research of the highest grade in the country.

C. V. RAMAN.

Research has made available foods relatively new to our civilization not alone from the standpoint of new varieties but chemicals used for treatment increasing their quality, size and vitamin content. Gases such as ethylene, propylene and butylenes hasten fruit ripening and growth. Ethylene is used for ripening of oranges and for the growth of potatoes. It has been reported that the speed of growth of potatoes has increased 100 per cent. when the seedlings have been treated with ethylene. The growth time to maturity is shortened while at the same time the potatoes are more numerous and larger and contain higher percentages of vitamin C. Butylene gas has also a stimulating effect on the speed of growth of trees such as the apple. Acetylene is being used in Australia to increase the growth of pineapple plants. Calcium carbide is placed in the heart of the plant and rain or dew reacts with it to produce acetylene in sufficient quantities. In California fruit orchards are fertilised by ammonia added to irrigation water, which has markedly improved productivity. Colchicine, an yellow powder obtained from the autumn crocus plant, when applied to seeds, leaves or buds of plants, increases the growth of fruits and vegetables to double their normal size. Colchicine also gives rise to new varieties of fruits and vegetables never known before.

A number of processes have also been developed to dehydrate foods in order to cut down their weight and bulk. "Quick freezing" of fruits, vegetables and meat has added materially to food supply and also conserves steel and tin in the form of cans. The impact of these researches will develop enormously in that one may work out new hormones and chemical stimulators which will give rise to new plant life. Obviously also all these developments will make it possible to raise more food of higher nutritive quality on less acreage and with far less labour compared to present methods.—(According to G. Egloff, *Science*, 1943, **97**, 103).

POST-WAR PROBLEMS OF THE INDIAN LAC INDUSTRY

BY

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ALL indigenous products, agricultural, mineral and sylvan, have lost their foreign markets at the present moment, to a smaller or greater degree, and this has imposed a necessity for a review of the situation both during the war and after. In certain cases, the present difficulties have been a blessing in disguise in so far as they have provided an incentive for the development of industries in this country to produce out of the indigenous raw materials substitutes for many imported commodities. There is a great apprehension that some of these industries which the war has brought into existence will disappear at the cessation of hostilities, especially in cases where the present developments are based on uneconomical foundations. But one can safely assume that some at least of the many industries will survive and cater to the post-war needs of India. It can be assumed further that an improved standard of living, not improbable as a result of the war, will also contribute to the continuance of industries based on the proper utilisation of raw products in this country, and the most ideal position will be to so far improve the industries as to be able to create a certain amount of export market after the internal needs are met. Then again, it is extremely probable that at the end of the present war, under a new order of things, there would be certain large-scale basic industries in India, which would bring in their train several accessory industries. Industrial production of war materials will naturally decrease, but it would be difficult to imagine that some of them at least would not be capable of being turned over to the production of peace-time requirements, with a minimum of dislocation as regards plant and equipment. One hopes, at any rate, that a country like India, which as yet is not adequately industrially developed, and as such differentiates itself from the already fully industrialised counntries, would require every machine and plant installed during the present crisis for meeting her future industrial needs; this expansion will be aided also by the large number of technically trained personnel that will be released all of a sudden at the end of the war. It may be hoped, therefore, that the nightmare of a slump after the war may end in a pleasant and fruitful industrial awakening of the country.

Another view-point, which may be stressed in this connection, is that under existing world conditions it is absolutely essential in the interests of any country to organise its industries in such a way that, in case of aggression from other nations, it can always have the necessary potential for large-scale armament production. In this respect India had been woefully deficient in the past and to secure and maintain a position of safety, such new industries will have to be permanently established. It would be reasonable, therefore, to expect that certain war industries brought into being due to the present emergency would continue as such, though on a reduced scale and, if necessary, develop to a larger extent, so as to have the necessary provision for self-defence, although it may be felt that no country's peace is worth the name excepting in a comity of nations. It will be unwise to overlook that a minimum of war industries would always be a matter of national safeguard.

So far, India may be regarded mainly as an agricultural country without a proper agricultural industry. The by-products of agriculture and forestry would constitute raw materials for various industries and in this region lies the need for extensive theoretical and technical researches to be able to successfully utilise them. This would enable the country to minimise, if not altogether stop, the import of manufactured products based on natural or synthetic materials. The acid test will, however, always be whether indigenous manufacture could be effected at an economic level to face external competition. The position of lac is rather peculiar in that it is not a by-product but a raw material which has been in demand all over the world for the fabrication of many industrial articles. Whilst the use of the lac-dye (which was the main ingredient for which lac was appreciated in the past) has practically disappeared with the advent of synthetic dyes, the value of the lac resin itself has been recognised for more than forty years in certain specific industries where the synthetic resin has not as yet been able to make any substantial headway. The extraordinarily rapid development of the synthetic resin industry in foreign countries has not, however, created a fall in the demand for shellac as will be noticed from Table I.

Thus lac exported into foreign countries has been more than able to hold its position in the industries in which it was being used. And this, in spite of the fact that chemists by the hundred had been systematically exploring the possibilities of synthetic resins in various laboratories in the world during the period 1910-1926, when only occasional and small-scale researches were being carried out on lac. To mention only one example, more than 230 chemists and engineers were at one time or another engaged on the development of Nylon, the synthetic resin fibre, the total annual output of which is to-day about 7,000 tons. An inference may be drawn, therefore, that the position of lac after the present war will continue to be at least as good as before, if not better, on account of the very intensive research that is being lately carried out to find out newer uses of this resin.

The idea that every raw material or by-product should be fully exploited in the country

TABLE I

Exports of Lac (Crude and Refined) from India

Year	Weight	Value (Rupees in thousands)	Calculated price per cwt.
	Cwt.	RS.	RS. A. P.
Pre-war average—			
1909–10 to 1913–14	434,351	22.015	54– 1– 9
War average—			
1914–15 to 1918–19	345,376	25,706	74– 6– 9
Post-war years			
1921—22	434 934	79,158	198–11– 3
1922—23	476,011	102,562	242– 0– 7
1923—24	485,671	90,627	203– 3 0
1924—25	427,017	75,506	191– 3– 4
1925—26	539,924	69,010	138– 5– 3
1926—27	592,030	54,724	101–12– 3
1927—28	543,584	69,886	140– 9– 9
1928—29	743,403	86,426	128– 6–10
1929—30	668,914	69,672	113–13–10
1930—31	547,151	31.374	62– 6– 5
1931—32	463,724	18,394	43–11– 6
1932—33	418,300	12,424	31–13– 6
1933—34	730,545	24.624	33–11– 2
1934—35	585,194	33,110	56– 9– 3
1935—36	487,801	15,828	32– 7– 2
1936—37	836,405	23,494	28– 1– 5
1937—38	665,525	16,198	24– 5– 5
1938—39	642,054	12,639	19–10–10
1939—40	760,399	19,119	25– 2– 3
1940—41	597,864	22,543	37– 1– 1
1941—42	766,707	49,208	64– 2–10

of its origin, supported, if need be, by public and State patronage, is not as widely appreciated as it should be. Nor is there as much planning as is desirable for co-ordinating production of the same article by alternative methods. To secure the highest economic value of national industries, not only a good deal of adjustment on a wide scale and in details within the country is necessary but even the putting up of a temporary, high tariff-wall against foreign imports should not be stigmatised as a retrograde step. To face the competition of synthetic resins, industries based on lac must needs be carefully and almost affectionately protected during the earlier stages of their development.

The position of the shellac industry after the war has often been a subject of enquiry at the Indian Lac Research Institute. Whilst at the present moment an internal consumption of shellac to the tune of 33 per cent. of the total produce has been claimed by some authorities, there is no doubt that the pre-war figure of 2-3 per cent. home consumption has been very much exceeded and the demand for shellac still continues. This increased consumption is due to the establishment of several new industries in the country, which were hitherto unknown, as a result of researches carried out by the Indian Lac Cess Committee, the Board of Scientific and Industrial Research, and the Indian Institute of Science, Bangalore. Amongst the new materials may be mentioned a dressing for anti-gas fabrics, "windolite" varnish, laminated paper and jute boards, water-proof abrasive papers, water-proof book-binding cloth, bobbin enamels, shellac moulding powders—both injection and compression—emery grinding wheels, non-shattering petrol containers, artificial leather-cloth, insulating varnishes, plywood adhesives, enamels and lacquers for various metallic surfaces, radio parts, etc. If one scans this list, he would have scarcely any hesitation in concluding that excepting the consumption in anti-gas fabrics, the others would be permanent industries after the war, consuming a very considerable quantity of shellac in their manufactures. Thus, for example, the moulding industry for general purposes alone may consume as much as 1,000 tons of lac or 2,000 tons of Kiri, a by-product in the shellac industry; lac recovered from Kiri would cost only Rs. 10-12 per maund, a figure which can scarcely be approached by synthetic resins. This is the least quantity that one can reasonably think of, but there is every possibility that with an improved standard of living and a desirable economy in the conservation of metals, plastics from shellac would claim a larger and still larger share in the economy of life, provided also that intensive researches to better the properties of this unique resin are continued.

The economic aspect of shellac plastics should not be lost sight of to appreciate its future possibilities. Under normal conditions, shellac moulding powders could be produced at 2½-3½ annas per pound, whilst no powder based on a synthetic resin could be fabricated under twice that cost. As further researches are brought to bear on this problem, there could be no doubt that improvement in properties would ensue and popularity of shellac plastics would increase.

An industry of singular value and potentiality can be envisaged in laminated boards of paper and jute, the latter being an important Indian industry, the waste from which could serve as a raw material to be bonded with adhesives developed from shellac. The significance of shellac adhesives in their application in plywood industry cannot be overestimated, and recent researches at the Indian Lac Research Institute show excellent promise of a lac-*cum*-synthetic of high elasticity and toughness, the use of which in the manufacture of various parts of motor cars and aeroplanes may be envisaged. So is the scope of shellac for use in water-proof abrasive papers, artificial leather, book-binding cloth, oil-cloth, grinding wheels, stoving enamels and lacquers, of which large quantities are now being imported into this country.

As the use of electricity spreads into smaller towns and villages, and radio becomes more popular, the use of lac would multiply *pari passu*. The unique raw material, mica, which is so far exported into foreign countries, may then form the basis of an independent permanent industry in this country. In short, all the above industries arising out of the recent researches on the utilisation of lac, may be expected to be established on a sound basis in the post-war period.

In the appendix is given a comprehensive list* of the known uses of lac products which will indicate how versatile lac is for industrial applications.

Without going into further details, it may be emphasized at this point how important both fundamental and technical researches on lac are to ensure its large-scale application now and after the war. Every new application leads to further consumption of this unique resin and one could, in short, state that the share of this natural commodity in big industries will be determined by the already known properties of lac as also future modifications that may be brought about by intensive research.

The consideration of an economic price level for this resin is probably one of the most important to keep this material on the map; for, it must be admitted, that for the disposal of quite a considerable portion of the lac produced, we have as yet to look for export into other countries. So far, the cheaper synthetic resins may be priced at 9*d.* to 1 *sh.* per pound and to secure a progressive trade in shellac, after allowing for its various qualities above the synthetics as also its deficiencies in comparison with them, its (shellac) normal price should be of the order of 6 to 8 annas per pound, that is to say, Rs. 30 to Rs. 40 per maund. No doubt such prices have been available for shellac, but during the few years before this war the price of shellac reached a level as low as Rs. 14 per maund. The law of supply and demand must have mainly operated to bring down the price of shellac to such an uneconomic level, but with increased use of lac in newer industries there is the chance of an ever-widening field for its production and maintenance of a reasonably profitable price of Rs. 30-40 per maund in competition with the synthetic resins.

A question has often been asked: Is it possible to increase the production of lac to the same tune as the synthetics? To that the answer is: At present 40-50 thousand tons of lac are being annually produced as against 150-200 thousand tons of synthetics. *With a reasonably attractive price for lac*, it will be possible to reach this figure for synthetics in ten years. Some very interesting work of the Entomological Section of the Indian Lac Research Institute has already shown that by slight modification of the existing method of lac cultivation, about a third more of lac can be produced. The indiscriminate cutting down of *Ari* lac (immature lac) due to the poverty of growers, if once stopped by co-operative loans, would enable the growers to bring more trees under infection resulting in increased output. New cultural methods like artificial defoliation before the natural leaf-fall begins and partial pruning in early spring can considerably improve the yield of lac on trees carrying a crop.

As further researches enable us to have a real glimpse into the structure of shellac, it may be hoped that its constituents would be the starting material for new synthetic products and the now-forgotten dye, as far as signs show, may be the source of pharmacologically active preparations. During the War of 1914-18, it was feared that in the post-War period the demand for shellac would decrease due to the advent of synthetic resins, but curiously as mentioned before this did not happen. There is no reason, therefore, to anticipate any retrogression after the present war, more so, as newer avenues of the uses of lac are being opened up through the experiences of the present war. An industry the annual export value of the products whereof has been of the order of 4·6 crores of rupees on an average for 21 years, deserves more careful handling in the field as well as in the laboratory.

* "The Story of Lac," A. J. Gibson, *Journal of the Royal Society of Arts*, 1942.

APPENDIX

The Known Uses of Lac Products

A. Shellac Varnishes

(*a*) *Spirit and Alkali Varnishes*:—

I. Insulating varnishes and impregnating compounds—
1. To prevent copper wire "greening": Hard lac—alcohol; Shellac—*p*-toluene sulphonamide.
2. To resist effect of lubricating oils and greases: Shellac—alcohol; Lac—glycol ether in solvents.
3. In micanite and micafolium: Shellac—alcohol (dry powdered lac).
4. (i) In building up paper and fabric tubes and impregnating tape and fabrics: Shellac—alcohol; Shellac—glycol ether; Hard lac resin and alcohol; (hot spraying of dry powdered lac). (ii) Greaseproof paper: Bleached lac—alcohol.
5. To resist high temperature: Shellac—glycol ether and alcohol.
6. For brake linings: Shellac in solvents; Hard lac resin in solvents; Shellac—tung oil varnish.

II. Shoe Trade—
1. Shellac stiffeners for toe and soles of shoes, etc.: in alcohol solutions; in ammonia solutions.
2. Shellac varnishes and finishes: in alcohol solutions; in ammonia solutions; in borax solutions.

III. Leather Trade—
Pigmented and unpigmented shellac finishes: in alcohol; in ammonia; Shellac—stearic acid compound; Shellac—metallic oxides and alcohol.

IV. Hat Industry—
Felt and fur hats, service hats and helmets: Shellac and bleached lac: in alcohol solutions; in borax solutions; in other alkaline solutions.

V. Photographic Industry—
1. Negative varnish: Shellac—alcohol.
2. Anti-halation plate and film backing: Soft lac resin in alkali solution; Hydrolised lac in alkali solution.
3. Dry mounting paper: Paper tissue impregnated with: Bleached lac—alcohol solution.
4. Preparing photographic graticules: Shellac solutions.
5. Photosensitizing processes: Cold tops in photo-engraving and etching; Shellac—

alcohol; Hard lac resin—alcohol; Shellac in aqueous ammonia and ammonium dichromate.

6. For protecting sound tracks on "talkie" films: Dewaxid shellac—nitro-cotton and solvents.

VI. Protective coatings for wood, paper, metal, and fabric—

1. French polish: Shellac—alcohol; Hard lac resin—alcohol; Shellac—metallic oxides and alcohol; Bleached lac—alcohol; Shellac—urea and alcohol; Shellac—alcohol—ammonia.
2. In medicine: For semi-rigid bandages; for coating pills; Shellac in alcohol.
3. In confectionary: Glazing candies and chocolates; Shellac in alcohol; Bleached lac in alcohol.
4. For burnishing coffee beans: (Dry powdered shellac).

VII. Polishes and finishes generally—

1. Shellac—esters: Rosin-shellac ester in turpentine and white spirit; Shellac—stearic acid ester as above.
2. Shellac—sodium bisulphite: for distempers; for coatings resistant to petrol.

(*b*) *Shellac Varnishes: Other Types*:—

1. For spraying: Cellulose nitrate—shellac and alcohol plus other solvents; Ethyl cellulose as above; Bleached lac as above; Dewaxed lac as above.

(*c*) *Shellac Oil Varnishes*:—

1. For general application: Shellac—drying oil—fatty acid—glycerol; Shellac esters—mono- and polyglycerides—drying oils.

(*d*) *In Inks*: Waterproof ink; Coloured inks; Lithographic inks; Shellac in alkali or alcohol solutions with other materials.

(*e*) *In Paints*: Antifouling compositions: Road paints: Solutions of shellac with other materials, poisons, pigments, etc.

B. Shellac Cements and Adhesives

1. For glass to glass, glass to metal, metal to metal, etc.

Cements:—Dekhotinsky cement: Shellac—pine tar; Pettman's cement: Shellac—Stockholm tar; Laboratory cement: Shellac—Venice turpentine; Shellac—lac-glycol ester; Electric bulb cement; Shellac—marble powder-zinc oxide and alcohol.

Adhesives:—Shellac—tartaric acid and alcohol; Shellac—rubber latex and ammonia; Shellac rubber and solvents; Dewaxed lac—lac glycol ester.

2. For abrasive wheels, emery paper, blackboard surfaces: Shellac—alcohol. Hard resin—alcohol; Hard lac resin—urea and alcohol.
3. Sealing wax: (i) As such: Shellac with fillers; Bleached lac with fillers. (ii) In turnery and toys: Shellac and colouring media; Coloured dry lac, in sticks.
4. Optical instruments: Shellac in alcohol; modified lacs.
5. Semi-rigid and flexible cements: To resist various solvents: modified lacs; Shellac—lac acids and glycol ester.
6. For rubber manufactures: (1) Rubber soles and heels; (ii) Rubber sheet: modified lacs and shellac; (iii) for rubber surface lacquers: Lac glycol ether with nitro-cellulose in solvents.

C. Shellac Mouldings

For Gramophone Records; 46 Electrical uses; Dominoes; Draughtsmen; Dental plates; Shellac in various forms: (1) Open moulding; (ii) Closed moulding; (iii) Injection moulding.

Shellac, hard lac resin and modified lacs in combination with: Stearic acid; Fillers, micronized mica; Phenol formaldehyde; Formaldehyde; Urea; Melamine; Protein; Cashewnut shell oil; Jute.

D. Other Uses

Bengal and signal lights and rockets; Pyrotechnics generally; in foundry work; Playing cards finish; Stiffening crepe; American cloth, Waterproof silk and sou'wester finishes; Sweets and cheese metal foil finishes; Hard lac resin in alcohol.

Tank steamer coatings: Shellac; Hard lac resin; Modified lacs.

Lac products as starting materials for synthesis:—Cosmetics: Hair dyes; Fingernail polishes. Shellac in solvents; Hard lac resin in solvents.

E. Bleached Lac (48)-(50)

Seedlac or shellac dissolved in alkali, bleached with chlorine precipitated with acid, washed and dried and sold in powder or hanks.

Used principally in categories A, B and D of the chart. Annual production 7,000 tons, principally American; Bleached hard lac resin; Bleached soft lac resin.

"The history of research is full of men who duplicated Columbus' experience of hunting for a trade route and finding a continent. It was through effort to create synthetic rubber that the quick-drying lacquers, which have meant so much to the automobile industry, were developed. J. W. Hyatt started experiments to produce synthetic billiard balls, but accidentally developed a material for making non-wilt collars and cuffs instead. Then Doctor Baekeland came along with an idea for synthesizing phenol and formaldehyde, but developed a material which makes the ideal synthetic billiard ball, through the discovery of *Bakelite* phenolic resinoids. Acheson started out to improve the production of graphite, cooked some coke and sand together, and produced silicon carbide instead. In our own work on fuels, it was an incorrect theory that led us directly to the discovery of the first anti-knock compound, iodine, and later put us on the right track to tetraethyl lead. The point I want to make is that though you end up one hundred and eighty degrees from the thing you may have aimed at, you do end up with something, if you keep working."—(Charles F. Kettering in "Prospecting for Knowledge" in the *Bakelite Review*, Jan. 1942.)

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A SIMPLE OPTICAL METHOD OF DETERMINING YOUNG'S MODULUS

MANY simple methods are available for the determination of Young's Modulus, but most of these require a considerable length of the wire whose Young's Modulus is to be determined, if sufficient accuracy in the value of this constant is desired. The method described in this note is suitable for small lengths of wires and gives reasonably accurate results.

Fig. 1 shows the arrangement of the apparatus. A glass cube C is mounted on a drum D which is rigidly fixed to a frictionless wheel F. The latter is free to rotate about the axis of the drum D. One end *a* of the experimental wire is fixed to a rigid iron-bracket W fixed in the wall. At the point *b* the wire is fixed to the drum D by means of a screw

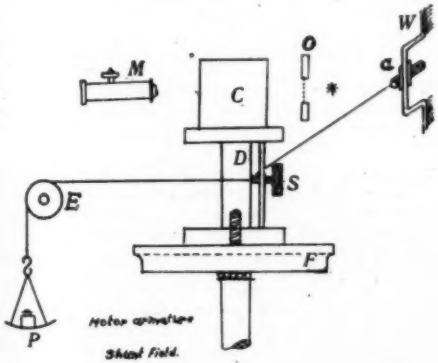

FIG. 1

arrangement and it is then taken round the drum in such a way that the two parts *ab* and *b*E are at right angles to each other and in the same horizontal plane. A scale pan P is attached to the end of the wire passing round the pully E. A travelling microscope M reading upto 0·002 cm. is used to measure the lateral shift of the image of an object (a fine thread) illuminanted by a lamp. The lateral shift, caused by the refracting glass cube C, being at right angles to the axis of the microscope, the latter is accurately set so as to have its motion exactly perpendicular to the incident ray. Fig. 2 gives a sectional view of the apparatus as seen vertically from above. The dotted square is the glass cube C and the dotted circle is the drum D (with its centre at Q) round which the wire passes.

When a load is added to the pan P the part *ab* of the experimental wire is stretched and hence the drum D is rotated in the direction shown by the arrow in Fig. (2).

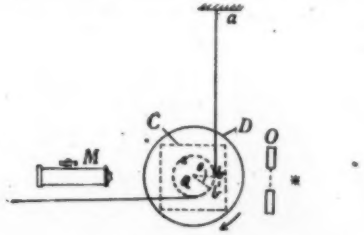

FIG. 2

In order to know the relation between the lateral shift of the image and the angle of rotation θ of the drum D or the glass cube C a preliminary experiment was performed with the glass cube C mounted on a spectrometer table. A graph of lateral shift against the angle of rotation was carefully plotted so that one could read from the graph a rotation up to half a minute and a lateral shift up to 0·002 cm. with sufficient accuracy.

A typical set of observations for a piece of brass wire is given in Table I.

TABLE I

Load in gm.	Loading		Unloading		Mean value of the shift for 300gm. in cm.	Grand mean of the shift for 300gm.
	Shift in cm.	Shift for 300gm. in cm.	Shift in cm.	Shift for 300gm. in cm.		
0	10·354		10·352			
100	10·344		10·342			0·035 cm.
200	10 332		10·330			
300	10·320	0·034	10·318	0·034	0·034	$\therefore \theta =$
400	10·308	0·036	10·306	0·036	0·036	1° 12·5′
500	10·296	0·036	10·296	0·034	0·035	from the
600	10·284	0·036	10·284	0·034	0·035	graph

Radius of the drum D = 1 cm.
Material of the wire, = Brass.
Length " " " l = 50·3 cm.
Radius " " " r = 0·015 cm.
Hence the extension " x = 0·0211 cm.

Young's Modulus $= \frac{wg/\pi r^2}{x/l} =$

$$= \frac{300 \cdot 980 \cdot 50 \cdot 3}{3 \cdot 142 \cdot 0 \cdot 015^2 \cdot 0 \cdot 0211} = 9 \cdot 92 \times 10^{11} \text{ dynes/cm.}^2$$

This method was used to determine the values of Young's Modulus for different metals generally used in the laboratories, *viz.*, Iron, Copper, Eureka, etc., and Table II gives a summary of the results obtained.

TABLE II

Material of the wire	Young's Modulus in dynes per cm.^{2}
Irom	$20 \cdot 18 \times 10^{11}$
Brass	$9 \cdot 92 \times 10^{11}$
Copper	$10 \cdot 91 \times 10^{11}$
Eureka	$16 \cdot 86 \times 10^{11}$

It seems possible that with little refinement, the method could be used to determine the Y.M. of thin glass fibres, silk threads, hair, etc.

I am indebted to Dr. D. V. Gogate for his useful suggestions and advice throughout the course of this work. My thanks are also due to Mr. L. V. Deshpande, B.Sc., for his help in taking some of the observations.

Physics Department,
Baroda College,
Baroda, K. R. CHAUDHARI.
May 25, 1943.

CONTINUOUS EMISSION BANDS IN THE SPECTRUM OF CCl_4

IN the course of an investigation on the high frequency discharge through stagnant and flowing CCl_4 vapour, we have observed a number of continuous bands as also reported by Asundi and Karim[1] in the emission spectrum of a discharge through flowing vapour of CCl_4. Table I summarises the data on the maxima of these bands and their features.

TABLE I

Numbers indicate wavelengths in Å of maxima

Asundi and Karim[1] (*a*)	Here (*b*)	Intensity (*c*)		Cameron and Elliot[2] (*d*)
		Flowing vapour	Stagnant vapour	
4600	4620	Strong	Strong	—
3348	3340	Weak	Absent	—
3070	3060	Strong	Strong	3063
—	2960	Weak	Absent	2957
—	2870	V. Weak	Absent	2881
2580	2560	Strong	Strong	2564
2430	2450	Weak	Weak	2432
2300 ?	—	—	—	—

(*a*) Read off from microphotometer curves.
(*b*) Read off from wavelength scale on spectrogram on a Hilger baby quartz spectrograph.
(*c*) Visually estimated only.
(*d*) From microphotograms of spectra, of high frequency discharge in chlorine gas.
? Doubtful.

It will be seen that all the bands except the two at 4620 Å and 3340 Å, are identical, within the limits of error, with those obtained in a discharge through chlorine. They are, therefore, in all probability due to Cl_2 or Cl_2^+. Such an interpretation of band at 2564 Å, is given by Cameron and Elliot.[2] Only the bands 4620 Å and 3340 Å are, therefore, to be regarded as characteristic of the CCl_4 discharge. They probably involve emitters containing both carbon and chlorine.

Asundi, *et al*'s[3] interpretation of the continuous bands observed in the spectra of flowing vapours of $SnCl_4$, etc., can be extended to the CCl_4 bands at 4620 and 3340 Å. Making use of the Born-Haber cycle and the various available thermochemical and spectral data required, the energy of dissociation of CCl_4 into unexcited atoms can be calculated. Using arguments exactly analogous to those for $SnCl_4$ it is possible to construct the simplified Franck-Condon diagram illustrating the intermediate steps of dissociation through which CCl_4 may be supposed to pass. Here, a knowledge of the internuclear distance C-Cl in CCl_4 and in CCl is helpful in drawing the curves rather accurately. It is found that it is possible to interpret the

strong band at 4620 Å as the result of a transition in the CCl_4 molecule from the ground level of CCl which is also known by its discrete bands, to the repulsive curve of CCl_4; and the weak band at 3340 Å, similarly to the transition from the same initial level to the repulsive curve of CCl_2, in complete analogy to the continuous spectra in $SnCl_4$.

College of Science,
Benares Hindu University,
June 9, 1943.

R. K. ASUNDI.
NAND LAL SINGH.
JAGDISH PROSAD MISHRA.

1. Asundi and Karim, *Proc. Ind. Acad. Sci.*, 1937, **6**, 328. 2. Cameron and Elliot, *Proc. Roy. Soc.*, 1937, **158 A**, 681; 1939, **169A**, 463. 3 Asundi, Karim and Samuel, *Proc. Ind. Acad. Sci.*, 1940, **12**, 513.

SPERM DIMEGALY IN *ICHTHYOPHIS GLUTINOSUS* LINN.

SPERM DIMEGALY or polymegaly appears to be unknown in the Apoda. Examination of *Ichthyophis* material revealed a number of dimegalous sperms of this animal. Scattered amongst the normal sperms in the testis, there occasionally is a sperm with a conspicuously large nucleus and which, on closer examination is seen to be double in respect of the "middle piece" and axial filament but single in respect of the nucleus and the acrosome. Such a sperm is shown in Fig. 1.

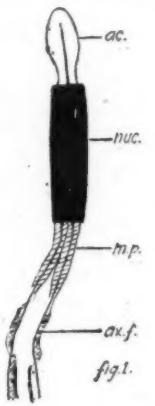

FIG. 1

Dimegalous sperm of *Ichthyophis glutinosus* × 2250

ac.—acrosome. *ax. f.*—axial filament. *m. p.*—middle piece. *nuc.*—nucleus.

It is generally known that in dimegaly, whether pathological or physiological, one or both divisions are suppressed in meiosis with the result that large-sized cells (primary or secondary spermatocytes) proceed to give rise to sperms by spermateleosis. Such di- and polymegaly has been known among insects, particularly the Hemiptera, where large giant spermatids derived from spermatocytes, either without any division or by fusion after division, proceed to give rise to giant spermatozoa.

The sperm figured above is a typical dimegalous one of *Ichthyophis*. The axial filament as well as the 'middle piece' is double while the nucleus and acrosome are single. But the noteworthy fact about both the nucleus and the acrosome is that they are double the normal size of these structures. The nuclear volume of a normal sperm of *Ichthyophis glutinosus* has been determined by me* to be about 25·1 cubic microns, while that of the dimegalous sperm described above is 49·9 cubic microns, nearly double that of the normal sperm. In the matter of the acrosome also, its size is very much larger than that of the normal sperm though I have had no means of calculating the actual volume of this structure.

Department of Zoology,
Central College,
Bangalore,
June 19, 1943.

B. R. SESHACHAR.

* Seshachar, B. R., *Proc. Ind. Acad. Sci.*, 1943, **27**, Sec. B. No. 5, 138.

DEGRADATION OF CHLOROPHYLL DURING TEA FERMENTATION

IN the manufacture of black tea the fermenting leaf changes its green colour to a coppery red tone. A rough estimation of this change of chlorophyll has been carried out by Carpenter,[1] Bokuchava,[2] as also in this laboratory, which show that the leaf loses about three-fourths of its chlorophyll during a four-hour fermentation.

Steaming arrests these changes completely, which indicates that an enzyme is concerned in the breakdown of the chlorophyll.

The degradation of chlorophyll may involve (1) formation of pheophytin by removal of Mg by plant acids, (2) hydrolysis by chlorophyllase whereby phytol is removed and (3) oxidation as a result of which the phase test is no longer obtained. Of these, that which tea leaf chlorophyll undergoes during fermentation appears to be limited to the last-mentioned. There was no evidence for the presence of chlorophyllase in tea. No pheophytin was detectable in the acetone extract of crushed leaf either before or after fermentation. During *in vitro* experiments the disappearance of green colour coincided with lack of response to the phase test, indicating an oxidation reaction. This was further confirmed by the fact that hot saponification of the 'fermented' chlorophyll product followed by treatment with acid did not yield phytochlorin *e* and phytorhodin *g*.

The mechanism of oxidation of chlorophyll appears to be as follows:

$$\text{Tea tannin} + O_2 \xrightarrow{\text{Polyphenol oxidase}} \text{O-Quinones}$$

$$\text{O-Quinones} + \text{Chlorophyll} \longrightarrow \text{Tea tannin} + \text{chlorophyll oxidation products}$$

Evidence for this lies in the fact that in the absence of tea tannin, chlorophyll is practically unaffected by tea enzyme. Moreover pure *p*-Quinone can effectively replace the system tea tannin + oxidase to give the same reaction as the latter with chlorophyll.

The disappearance of the green chlorophyll is a valuable indication of the progress and completion of tea fermentation which proceeds contemporaneously. It is easier to decide whether the greenish tint has disappeared than to judge whether a particular colour intensity of the insoluble oxidation products has been attained by the leaf residue. Tea tasters use this empirical colour test, the relevance of which this note explains, and deprecate any tea whose "infusion" (*i.e.*, spent leaf in their terminology) shows green tint after pressing out the liquor.

The insoluble 'infusion' pigment cannot, as suggested by Popatov[3] be a melanin produced by an enzymic oxidation of tyrosin which is supposed to arise from the breakdown of leaf proteins; for tea leaf not only does not contain tyrosinase but also the quantity of tyrosin liberated would be, if any, extremely small. The degradation of chlorophyll and the production of insoluble and coloured tannin oxidation products during the course of fermentation provide a more satisfactory explanation of the brown pigment in spent leaf.

Tea Research Institute
of Ceylon,
Talawakelle,
Ceylon, H. B. SREERANGACHAR.
June 10, 1943.

1. Carpenter, *Ann. Rep. Ind. Tea Assoc.*, 1930, 12. 2. Bokuchava, *The Biochemistry of Tea Production*, Moscow, 1935, p. 62. 3. Popatov, *The Biochemical Basis of Technology of Tea*, Tiflis, 1932.

INFLUENCE OF THE SIZE OF EXCHANGEABLE IONS ON THE PERMEABILITY OF SOILS*

IT is well known that the colloid-chemical properties of soils are greatly influenced by ions that enter the base exchange complex. Analogous ions affect these properties in a regular manner. Various lyotropic series have been formulated with reference to some specific property of the soil. Thus soils saturated with monovalent cations show a tendency to disperse in the order:

$$Li > Na > NH_4 > K > Rb > Cs.$$

Ram Das and Mallik[1] report that the swelling effect decreases with the atomic weight of the metallic radical, that is, in the order:

$$Li > Na > K > Rb > Cs.$$

A similar variation in the ζ-potential of the soil colloids saturated with these ions has been noticed by Hans Jenny,[2] according to whom the ζ-potential is an exponential function of the adsorbability of the ion which saturates the soil complex.

We have attempted to study the influence of the size of cations on the permeability of a soil. The soil was leached with N/20 HCl to remove $CaCO_3$ and to saturate the soil with hydrogen ion. After being washed with water it was divided into five portions. Each portion, which weighed approximately 15 to 20 gms., was leached with 2 litres of normal solutions of the chlorides of Lithium, Sodium, Ammonium, Potassium and Rubidium. These samples were then washed first with water and finally with alcohol until free from chloride and dried at 100° C.

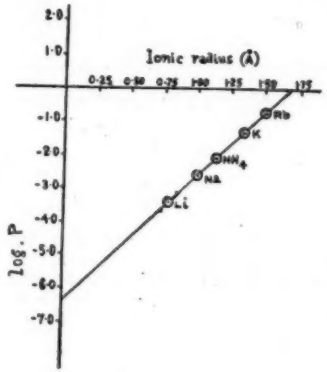

FIG. 1

The rate of percolation of water in each soil was then determined. For this purpose 10 gms. of the soil were placed between layers of sand in the experimental tube which was closed by a piece of muslin tied at the lower end. After wetting the sand and soil the same head of water (5 inches) was maintained in each and the rate of percolation was measured by noting down the sinking of the level of water. (To minimise the effects of evaporation the upper end of the tube was closed by a cork provided with a capillary tube). Table I gives the values obtained:

TABLE I

Ion	Radius Å	Rates of percolation (inch/hour)	
		Observed	Calculated
Li	0·78	·0005	·00048
Na	0·98	·0027	·00272
NH_4	1·14	·0115	·01084
K	1·33	·0600	·05598
Rb	1·49	·2250	·2239

It is evident that the rate of percolation follows the order of increasing ionic radius. If P be the rate of percolation and r the radius of the ion, the observed values can be correlated by the exponential equation $P = \lambda e^{\mu r}$. The constants λ and μ are determined graphically and the values of P recalculated from the equation $P = (50 \times 10^{-8})\, e^{8 \cdot 63r}$ are given in the last column of Table I.

In Table II corresponding results obtained with soils saturated with the divalent alkaline earth cations are reported.

TABLE II

Ion	Radius of the ion Å	Rate of percolation of water in inch per hour	
		Observed	Calculated
Mg	0·65	0·150	0·153
Ca	0·99	0·275	0·272
Sr	1·13	0·350	0·345
Ba	1·35	0·500	0·504

It is significant that the percolation rate follows the order

$$Ba^{++} > Sr^{++} > Ca^{++} > Mg^{++}.$$

The observed rates conform to the relation

$$P = 0{\cdot}127\ e^{1{\cdot}705r}.$$

It is clear that the rate of percolation is an exponential function of the radius of the ion which saturates the soil complex.

Chemistry Department,
Lucknow University, M. R. NAYAR.
June 2, 1943. K. P. SHUKLA.

* This work has been carried out under the auspices of the Irrigation Dept. (Research Section), U.P. Government.

1. Ram Das and Mallik, *Proc. Ind. Acad. Sci.*, **1942**, **16**, 1. 2. Jenny and Reitmer, *J. Phy. Chem.*, **1935**, **39**, 593.

ZODIACAL LIGHT AT POONA

ZODIACAL light has been discussed from many points of view by various people.[1,2,3] In this note the intensity of the Zodiacal light as seen at Poona in the evening after sunset on a moonless night at the western horizon like a dome vertically up has been studied visually. The maximum intensity of the Zodiacal light at different hours is compared with that of the star canopus, the observations being made from the second floor of a certain building (Wakekar's quarter) some forty feet high from the ground, on the Fergusson Road.

Table I gives the intensity of the Zodiacal light on 4-4-1943 from 20·55 hours to 21·30 hours I.S.T., that of canopus being taken as 10. Graph 1 shows the relation between the time and the intensity as given in Table I.

TABLE I

Time in I.S.T.	20·55	21·00	21·05	21·10	21·15	21·20	21·25	21·30
Intensity of Zodiacal Light	4	3	2	2	1	·8	·6	·6

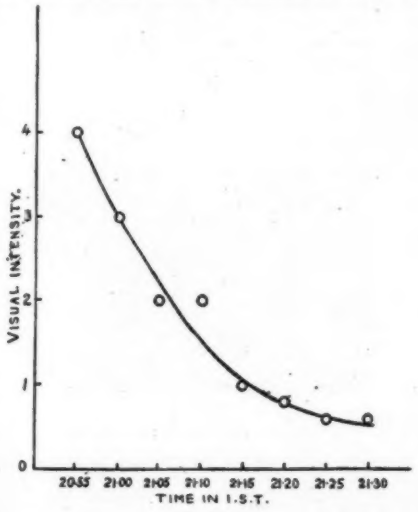

FIG. 1

Weather Office,
Poona, JAGDEO SINGH.
May 10, 1943.

1. *Science and Culture*, 1939–40, 312. 2. *Meteorology* by A. E. M. Geddes, p. 342 (Plate XX facing p. 342). 3. Spectrum of night sky and Zodiacal light—c Hoffmeister, *Zeits. f. Astrophysik*, 1939, **19**(2), 116–131.

ALGAL STRUCTURES FROM THE CUDDUPAH LIMESTONES (PRE-CAMBRIAN), SOUTH INDIA

IN the course of a detailed examination of some of the limestones from the lower Cuddupahs collected from near Royalcheruvu, Anantapur District, certain remarkable algal structures have been noticed. In hand specimens, the limestone is a dark coloured fine-grained marble, showing in places an oolitic

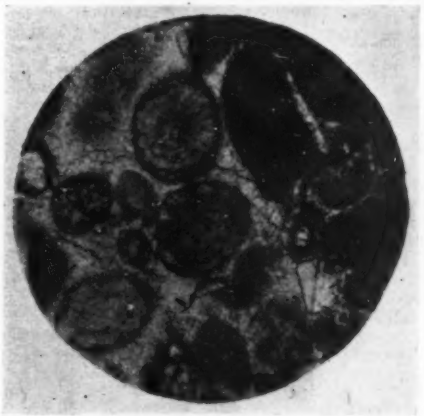

FIG. 1

structure. When examined under the microscope, sections of the rock are seen to be crowded with fragments of varying shapes and diameters, and quite distinct from the oolitic structures. On closer examination, they show characters distinctly suggestive of the thallus of primitive algæ. One of them shown in Fig. 1 clearly shows a central cavity with a number of dark circular bodies arranged regularly along the periphery, the entire structure strikingly resembling a cross-section of the thallus of a Dasycladacea.

The author is grateful to Professors B. Sahni and S. R. N. Rao who very kindly examined the slides and agreed that the structures referred to above are of plant origin. The discovery of recognisable organic structures in these Pre-Cambrian rocks of India is evidently of considerable interest and importance, and a fuller paper dealing with this material will soon be published elsewhere.

Department of Geology,
Central College,
Bangalore, M. R. Srinivasa Rao.
July 12, 1943.

A NOTE ON THE DISCOVERY OF APTEROUS MALES IN THE PINK MEALY-BUG OF SUGARCANE, *TRIONYMUS SACCHARI* CKLL. (COCCODÆ HOMOPTERA)

The adult males in Coccidæ are generally winged, while the females are wingless. In some genera, like *Fonscolombia*, however, the males are always apterous, while in others (*Tachardinæ*) the males are sometimes so. Apterous and winged males are also said to occur in the genus *Gossyparia* which belongs to the Sub-Family *Dactylopinæ*. In the case of *Aclerda berlesei*, Leonardi (1920) mentions

Fig. 1

the existence of males with atrophied wings besides the winged ones. Herbert (1924) reports forms representing varying gradations between the winged form and the apterous condition.

There appears to be no previous record of the occurrence of apterous males in *Trionymus sacchari* Ckll., either from this country or elsewhere. While studying the biology of the pink mealy-bug some forms came under observation which when examined microscopically, resembled in all essential respects, the alate male except in the possession of wings and compound eyes (Fig. 1). The cuticle of this apterous form is not sclerotised in the principal regions of the body, the three penultimate abdominal segments bear a pair of long setæ like those of the adult female, a pair of ocellanæ present but compound eyes absent, antennæ have eight joints instead of ten in the winged male. Spiracles, legs and stylus of the wingless male do not differ in any essential respects from those of the winged one. The apterous male of *T. sacchari* resembles that of *Stomococcus plattani*.

Imperial Sugarcane Station,
Coimbatore, S. Ram Mohan Rao.
June 18, 1943.

1. Leonardi, G., *Monografia delle cocciniglie italiane*, Portici, 1920. 2. Herbert, F. B., "The European Elm Scale in the West", *United States Dept. Agri., Dept. Bull.* 1924, No. 1223.

ARTIFICIAL GERMINATION OF RICE POLLEN

In view of the importance of pollen viability tests to rice breeding, a detailed study of the optimum conditions for artificial germination of the pollen was undertaken. The combination of various culture media, temperature and humidity were re-tried but without satisfactory results. The following technique was, however, found to give consistently better results and uniform germination.

The experiments by the author have shown that given proper humidity and temperature, the rice pollen germinates without any culture solution. The humidity required is 100 per cent., but it is important that it is not supplied by a sheet of water directly below, as when humidity was supplied this way, the percentage of bursting was very high. After

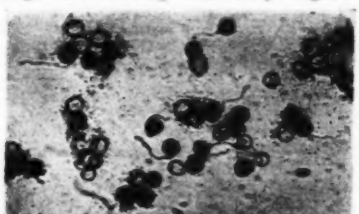

Fig. 1
Germinating pollen grains × 135

a number of trials it was found best to germinate the rice pollen inside a desiccator. The bottom of the desiccator is fielled with water and a layer of filter-papers or a pad of cotton wool soaked in water is placed inside the

desiccator. The pollen is dusted over a glass slide and the slide placed (pollen side upwards) on the filter-paper. The desiccator is then placed inside a chamber in which a temperature of 28° C. or 29° C. is maintained.

FIG. 2

A highly magnified pollen tube of average length × 950

Grown in the above manner, the rice pollen has been giving consistently from 50 per cent. to 60 per cent. germinations and the length of the tubes has been about 130 μ to 140 μ with a maximum of 238 μ. Unlike other methods, this technique has yielded consistent and reproducible results.

My thanks are due to Mr. C. R. Srinivasa Ayyangar and to Mr. N. L. Dutt for help and advice.

Paddy Section,
Agricultural Research Institute,
Coimbatore, M. K. VENKATA SUBRAMANIAN.
May 15, 1943.

ON THE ACTIVE PRINCIPLES OF THE BARK OF *AEGLE MARMELOS* CORRÊA

Ægle marmelos (family: *Rutaceæ*), commonly known as Bael, is indigenous to India and is reputed to be a valuable Ayurvedic remedy for various intestinal complaints. The bark as well as the fruits, both ripe and green, have been used for this purpose.[1] A chemical examination of the fruits by various workers has revealed the occurrence of a coumarin[2] (marmelosin) identical with a furocoumarin (imperatorin)[3] isolated from *Imperatoria ostruthium*[4] and *Angelica archangelica*.[5] As, however, no chemical examination of the bark has so far been reported, the present investigation was undertaken.

The barks of young and old plants procured from different places in Bengal and Bihar were sun-dried and the following five active principles isolated in a pure state, employing the usual methods of separation.

The young barks of both Bengal and Bihar gave (i) a coumarin (A) (yield—0·03 per cent.), which crystallises, has shining silky needles, m.p. 123° C. from ethyl acetate, acetone and petroleum ether; (ii) an alkaloid (B) (yield—0·003 per cent.) as rhombic plates, m.p. 175° C.; and (iii) umbelliferone (7-hydroxy coumarin). The old barks of both regions gave the same umbelliferone (iii), but (iv) a different coumarin (C) (yield—0·6 per cent.) which crystallises as colourless shining rods, m.p. 187-188° C., from alcohol, acetone and benzene. The same alkaloid (B) was yielded by the old barks of Bengal, but those of Bihar gave (v) a new alkaloid (D) (yield—0·3 per cent.), which crystallises as thick colourless plates, m.p. 142° C., from alcohol and ethyl acetate. It would appear from the above facts that not only the age of the plant, but also ecology plays an important role in the biogenetic synthesis of active principles in plants.

Further work is in progress.

The author is indebted to Prof. P. C. Mitter for laboratory facilities and to Dr. P. K. Bose for advice and encouragement.

University College of Science
and Technology, Calcutta,
April 26, 1943. (MISS) ASIMA MOOKERJEE.

1 Kirtikar and Basu, *Ind. Medicinal Plants*, **1**, 492. 2. B.B.L. Dikshit and S. Dutt, *J. Ind. Chem. Soc.*, 1930, **7**, 759; 1932, **9**, 271. 3. E. Späth, P. K. Bose, W Grüber and N. C. Guha, *Ber.*, 1937, **5**, 1021. 4. E Späth and H. Holzen, *Ibid.*, 1933, **66**, 1137. 5. E Späth and F. Vierhapper, *Ibid.*, 1937, **70 B**, 248.

PRODUCTION OF PENICILLIN

THE yield of the unstable Penicillin is found to be generally small and the process is lengthy, requiring an incubation period of 12 days at 24° C. on modified Czapek-Dox media.[1] Hobby *et al.*[2] reduced this period to 8 days by using brown sugar instead of glucose. Challinor[3] has reported that this time could be still further reduced to 5 days by adding small amounts of metabolic solution from previous batch to the culture vessel before seeding with *Penicillium notatum*.

All the previous workers have grown the fungus in liquid sugar media involving the handling of large volumes of solution. We are probably the first to grow this fungus on semi-solid media like those tried by Oshima and Church[4] with a view to study the development of anti-bacterial activity. We found that the maximum anti-staphylococcus aureus activity was reached within 3 days. The activity of the nutrient medium after 3 days' growth diluted ten times with distilled water and sterilized by filtering through L 3 candle was found to be 3 to 4 'Oxford Units'. This activity of the metabolic solution is the same as that reported by Florey and Jenning[5] and we have verified this by growing the fungus in Czapek-Dox media for 12 days at 24° C.

Another point observed by us is that though the antibacterial activity reaches its maximum in 3 days, the production of the dye chrysogenin[6] is at this stage very little. One more point of importance is that the anti-bacterial potency of the nutrient semi-solid media did not come down very much even after storing it at room temperature for a period of 3 weeks.

Department of Biochemistry,
Indian Institute of Science,
Bangalore, S. SRINIVASA RAO.
June 10, 1943. S. P. DE.

1 Abraham, Chain, *et al.*, *Lancet*, 1941, **241**, 177 2. Hobby, *et al.*, *Proc. Soc. Exp. Biol. & Med.*, 1942, **50**, 277. 3. Challinor, *Nature*, 1942, **150**, 688. 4. Oshima and Church, *Ind. Eng. Chem.*, 1923, **15**, 67. 5. Florey and Jenning, *Brit. J. Exp. Path.*, 1942, **23**, 120. 6. Clutterbuck, Lovall & Raistrick, *Biochem. J.*, 1932, **26**, 1907.

REVIEWS

Prism and Lens Making: A Text-Book for Optical Glass Workers. By F. Twynman. (Adam Hilger, Ltd., London), 1942. Pp. 178. Figs. 63. Price 15 *sh.* (postage 5*d.* extra).

Optical manufacture is a highly specialised industry, the success of which depends on the combination of a thorough knowledge of optical principles and the development of carefully worked out processes for the selection of raw materials and for the grinding, polishing, figuring and testing of the desired products. No authoritative book exists so far giving working details of the industry, as the few optical firms who hold the world monopoly, carefully guard their methods as 'trade secrets'. The publication of the book under review by the Managing Director of the reputed optical manufacturers of Great Britain, should, therefore, be considered as a blessing by instrument technologists and students of optics alike. The book is divided into eleven chapters. After a brief historical introduction in chapter I, the author deals with the elements of single lens grinding in Chapter II. Chapter III gives a suggestive summary of the physical nature of grinding and polishing. The working details of trueing tools, measuring instruments, abrasives, and polishers are given in Chapter IV. The technique and machinery connected with the mass production of lenses and prisms are described in Chapter V. Chapters VI and VII deal with the finishing and balsaming of lenses and prisms singly and in batches, and Chapter VIII gives the essential details of equipment and the methods employed for testing of the finished products. The last two chapters touch upon the manufacture of microscope objectives and the testing of optical glass respectively. In four appendices, much useful information is collected together on light sources, reflecting surfaces, physical properties of glass, pitch, etc., and technical terms used in manufacture. The book is well-illustrated by diagrams and photographs.

The success in the production of optical instruments depends solely on the skill of the individual workman and it is a matter of deep gratification to notice that the author has given unreservedly the minutest details of the prevailing practices in the Hilger Optical Workshop. Difficulties in working, which are several, are specially mentioned in appropriate places and the remedies are suggested. The claim put forward by the author in the Preface that 'these methods and machines will enable even an unskilled workman, after a short period of training under competent supervision, to produce work of first quality' is none too exaggerated.

The volume would, however, have a wider appeal if it includes a few more chapters on the production of (1) optical flats and plane parallel plates, *e.g.*, Lummer plates, (2) telescope lenses and mirrors, and (3) prisms and lenses with materials other than glass or quartz, *e.g.*, calcite, rocksalt and fluorite.

The book will be received with special interest in India. Some preliminary attempts have already been made for the manufacture of optical instruments by Dr. H. Parameswaran and his co-workers. The publication of the present book by Prof. Twyman should give further stimulus to the advancement of optical industry in India.

C. S. VENKATESWARAN.

Radio Receiver Design—Part I. Radio Frequency Amplification and Detection. By K. R. Sturley. (Chapman and Hall, Ltd., London), 1943. Pp. 435. Price 28*sh.* net.

THE present work by Dr. Sturley of the Marconi School of Wireless Communication contributes an important volume to the fairly wide list of text-books on Radio Engineering. However it confines itself exclusively to the detailed considerations of the principles involved in the field of modern receiver design which are rather cursorily dealt with in general texts. As such, a lot of new material has been brought together on the subject for which previously recourse had to be taken to various wireless journals.

The volume under review forms Part I of the projected two parts and is divided into eight chapters. The order of treatment is reverse of that found in the usual books on Radio Engineering. This has been rather inevitable due to the choice of the subject-matter where the treatment is made to follow step by step the design procedure of receivers. Thus the first two chapters on general considerations and valves are followed by detailed chapters on receiving aerials and aerial coupling circuits, radio-frequency amplification, frequency conversion, oscillators for superheterodyne reception, intermediate frequency amplification and detection in the order mentioned. "Part II will deal with audio-frequency amplification, power supplies, receiver measurements, television and frequency modulated receiver design, etc." Possible criticism against the adoption of such a method of treatment may be advanced from purely pedagogical point of view; for instance, considerations on LC circuits and coupled circuits are given piecemeal in their applications in three separate chapters instead of a unified treatment of the same at one place. Nevertheless it can be said that it has served here to bring out the essential differences in the design features in each case.

Besides the descriptions of various types of receiving aerials such as the Vertical, Inverted L-type, T-aerial, the Dipole and the Frame aerial, and their terminal impedances, Chapter 3 gives generalized formulæ for transfer voltage, selectivity and mistune ratios and capacitance correction over the tuning range. Chapter 4 on r.f. amplification includes discussion on design principles for shortwave and ultra-shortwave amplification. About sixty pages of the text, comprising Chapter 5, are devoted to frequency changing where a

thorough treatment of this aspect of the design is given, both analytically and graphically. Special valves developed for this purpose—the triode-pentode, triode-hexode, pentnagrid, etc., —and various circuits employing them are described in some detail. Theoretical treatment on conversion conductance and methods of its measurement as well as the problem of image signal interference in all its aspects including construction of interference charts and suppression circuits are described at length. The treatment on oscillators in Chapter 6 is similar to what is generally found elsewhere except that the emphasis is on those designed for heterodyne reception. A useful feature of this chapter is the discussion on ganging problem showing a graphical construction for the determination of the padding and trimming capacitances; approximate expressions for ganged oscillator circuit components for different intermediate frequencies are also derived. The important features of Chapter 7 on i.f. amplification are the design of i.f. transformers, generalised selectivity curves for mutual inductance coupling and for cathode feedback. The final chapter on detection describes the main three types of detectors, *viz.*, diode type, cumulative grid and power grid types and anode bend type.

Analytical methods are freely used everywhere in the book and there are hardly a few pages where there is not any algebra or curves showing the analytical relationship of circuit parameters. Two small appendices at the end are usefully devoted to complex notation and Fourier Series method as applied to Radio Engineering problems. At the end of each chapter is given a bibliography of appropriate references to various wireless journals.

The only complaint that the reviewer feels obliged to make is that the author in giving an idea of atomic structure in the chapter on valves has based his statements on the old theory of the nucleus. For a book published in 1943 the atomic weight does not equal the gross positive charge on the nucleus for the latter has no electrons inside it—not even for a book on receiver design.

A minor slip in algebra occurs on page 37. Equation 2·5 e where $E_0 = I_m E_{1t} Z_0$ should be read instead of $E_0 = I_m E_{1t}$.

The book is to be heartily recommended to all those interested in Radio Engineering; the students and teachers alike will find it an important addition to their books for study and reference. It is indispensable to those whose interests lie in the field of modern receiver design.

N. B. BHATT.

Elementary Physical Chemistry. By Merle Randall and Leon Eether Young. (Randall and Sons, 2512, Etna Street, Birkeley, California), 1942. Pp. xiv + 455. Price $4.50.

One of the principal defects of the older methods of teaching Physical Chemistry has been to treat the subject as a distinct branch of Chemistry, isolated from other branches, so that its value in practical applications was not fully appreciated. This unfortunate circumstance is overcome in this new text-book, where the older abstruse handling of the subject is eminently replaced by one that treats Physical Chemistry as the very basis, or as the grammar, of the whole of Chemistry. This is achieved largely through the application of the practical experiments performed by students in the elementary organic and analytical laboratories to establish the fundamental physico-chemical principles. The laws of Physical Chemistry are no longer set in verbose enunciations, but are explained with practical illustrations and examples. The practical inseparability of Physical Chemistry from any other branch of Chemistry is thus emphasised most satisfactorily.

The arrangement of material is more stimulating to the student than the traditional order, in that the more immediate applications to his every-day experience are presented earlier in the book. In the opening chapter, a brief account of the modern concept of Chemistry is given. The succeeding chapters deal with the most familiar case of change of state, *viz.*, the vaporisation of liquids and solids. Then follow a few introductory chapters on the properties of electrolytes, with a view to bring out the principles of acid-base titrations. The elementary principles of thermodynamics are introduced in small doses from the very beginning, so that when the subject is elaborated in the latter part of the book the student finds it void of the usual hyper-mathematical presentation and appreciates fully its value in practical applications. The more advanced treatment of electro-chemistry is taken up only after the chapters devoted exclusively to Thermodynamics. Of particular interest to students of Chemical Engineering is a chapter on Flow of Fluids. Numerous references to original papers and more advanced treatises of Physico-chemical subjects have been included in this work.

The book is by no means elementary in treatment, for it has something to say on practically every aspect of Physical Chemistry. The matter is too highly compressed into a small volume to appeal to the junior student. It can, however, be recommended to the teacher, who can advantageously adopt the newer methods of teaching and can also draw upon the numerous practical illustrations, exercises and references given in the book. The work can aptly be described as a broad, if not ambitious, survey of modernized classical physical chemistry, which would enable those who have already studied the subject to appreciate the practical worth of their learning.

M. V. C. SASTRI.

Indian Mining: A Concise Handbook for Laymen and Specialists. By J. A. Dunn. (The Mining, Geological and Metallurgical Institute of India, Calcutta), 1943. Pp. xi + 262. Price Rs. 10, postage extra; Rs. 5 for members of the Institute.

In India, as in most countries, the vast and growing mineral industry forms the foundation of all other industries. Much of this is of a highly technical nature, and many of its workers are necessarily specialists along certain limited channels. The object of this book is to supply a general picture of this industry as a whole, so as to be at once useful to the layman and the several specialists in the different aspects of this vast subject. Therefore,

while the basic fundamentals are clearly outlined throughout, technical details have been restricted to a minimum, as they can and must be supplemented by experienced specialists. Chapters II and III give a broad picture of the distribution and mode of occurrence of minerals in nature. Chapters IV to XV outline the various phases of prospecting, sampling, methods of estimating and grading of minerals, estimation of reserves, mining and costs, and treatment of minerals and their marketing. Chapters XVI to XVIII explain how a mine is evaluated with reference to the several variables involved such as labour, transport, and marketing trends, and how an investor can estimate the relative value of mining shares. Chapters XIX to XXIII are concerned with various legislative aspects such as mining concessions, Acts, Taxes and Tariffs, etc.

Particular emphasis is laid in the Preface on the great utility of this book to laymen including officials who are interested in administration and those "hard-working folk" who are interested in mineral matters, trying "to earn a good living from innumerable small deposits scattered up and down the length and breadth of the country"; and also, to the large body of people interested in mining shares which are considered in general as risky speculations.

Although the book is seemingly stressing the financial aspects of mining industry, it is replete with useful informations to the industrial chemists, particularly in the chapters on Tests and Grading of the Indian Minerals, the different local mining costs, the respective treatments for these minerals, the conditions for Indian and foreign marketing, and costs. The book will thus be also useful as a valuable reference book in many chemical and industrial laboratories. It is besides very neatly got up and does great credit to the printers and publishers. Priced somewhat high, at Rs. 10, the entire profits from the sales will be contributed to an Indian War Fund.

Museum Method and the Process of Cleaning and Preservation. By Minendra Nath Basu. (Calcutta University), 1943. Pp. iv + 34.

"Unless there is a change in the near future, proof of India's cultural greatness in terms of handicrafts will disappear before our eyes and the historian of the future will have to go to Europe for evidence that centuries ago, India could weave, carve, compose and create superb objects of art and industry. Consideration of what should be done by the authorities in India to preserve for posterity her priceless treasures can no longer be postponed." So wrote Messrs. Hargreaves and Markham who reviewed museum work in India in 1936. The present handbook—the first of its kind in India—written by Mr. Minendra Nath Basu, M.Sc., P.R.S., and published by the Calcutta University, is intended to fill the gap and impart knowledge and training in the art of preserving museum exhibits. The author has shown initiative and enthusiasm in the choice and handling of topics. The Calcutta University may well be congratulated for taking this subject within its purview.

In the preface the author rightly complains that no work has been done on the control of humidity in the art galleries of Bengal, where problems of humidity are of great importance. Some work has, no doubt, been done on such problems for other climates in Europe and America. Unfortunately Indian museums and art galleries have not at hand the necessary resources in men and money and one can only hope that the University of Calcutta with all its resources would cope with this work.

The booklet deals with the cleaning and preservation of organic materials, pictures and paintings, foodstuffs and leaves, siliceous materials and metals. The subject of cleaning and preservation of museum exhibits is a new one in many countries in Europe and America, and it is more so in India. Exhibits are of various materials in varying stages of decay and discovered under very different conditions. Hence their cleaning and preservation become a complex subject and no generally uniform procedure can be recommended. Environmental conditions and destructive forces must be studied for each before any treatment. The author recommends the treatment of corroded copper alloys with ammonium chloride, stannous chloride and hydrochloric acid. At best this can be applied to mild cases of corrosion where there is abundance of metal. Evidently the author found the method a success in such cases. But if the metal is, however, porous, the chlorides might get lodged in the pores of the metal and give rise to 'bronze disease' and to eventual destruction of the alloy. Owing to this risk, the method is seldom followed to-day. Again he recommends that fabrics should be soaked in benzene and petrol for removing oil and grease stains or treated with alkalies. This is, no doubt, a good method for fabrics in a good state of preservation. But such a treatment hastens decay in the case of old fabrics. The author suggests the use of water for cleaning tempera, but advocates caution in its use for cleaning paintings on plaster. It is well known that certain classes of paintings on plaster such as the *fresco* do stand even rough cleaning with water. Generally the reader does not get a clear account of the conditions under which the author has worked, the nature of the objects actually treated by him, and the stability of the results attained. One interesting feature of the handbook is the suggestion for the use of a number of indigenous preparations such as potato and onion juice for cleaning paintings, green mangosteen extracts for strengthening fragile objects, chopped tobacco leaves and pepper as insecticides. In dealing with valuable antiquities, no method should be employed unless it is supported by successful experience and then the reader would have welcomed more experimental data on the subject.

S. P. S.

HOW FAST WILL MAN TRAVEL?

BODY LAGS FAR BEHIND MACHINE IN ABILITY TO TRAVEL AT SPEED

SCIENTISTS, hoping to step up flying speeds from the 500 miles-per-hour mark to within range of 1,000 m.p.h., are worrying more about man's physical constitution than they are about such things as wind resistance, stream-lining, engine-power, lift, acceleration and the host of mechanical factors which have to be reckoned with. For them, the probable behaviour of the blood is harder to estimate than the behaviour of assemblies of mental hurtled through the air at higher and higher speeds.

At the moment, really high speeds have been attained only in exceptional circumstances. For example, in a power dive (in which an American military plane has reached 650 miles per hour) or in a fast combat turn, the top speed is attained suddenly, within a few seconds of the lower speed. And the inability of the human body to face sudden accelerations of this intensity is the main obstacle to research in this sphere.

It is the actual acceleration itself, and not the very high speed, which causes the trouble. Experts are confident that any person of average sound constitution can smile comfortably through an acceleration in level flight of 30 metres per second, right up to 1,000 m.p.h. (1,610 km. per hour) in 15 seconds, and would feel no ill-effects afterwards. But even if peace-time should follow up military experience with 1,000 m.p.h. stratoplanes, no airborne machine which reaches such speeds can hope to keep all its accelerations to level flight. That is why scientific preoccupation in aeronautics is with tests on pilots after close turns at speed and after pulling out of power dives.

Different physical reactions occur according to the direction of the acceleration, the amount of acceleration, and the time it lasts. The scientific conclusion is that the position of the pilot's body may eventually decide his ability to withstand acceleration strain. For normal purposes the ordinary sitting posture is satisfactory. But the centrifugal force exerted at combat speeds drives blood from the head, concentrates it round the heart. The interruption of the circulation which occurs reduces the brain's supply of oxygen, impairs the vision and rapidly produces what pilots call "blackout". If acceleration continues, "blackout" changes to complete loss of consciousness, lasting several seconds. Consciousness is regained and vision restored rapidly after acceleration ceases.

In theory, a method of minimising ill-effects would be to support the body in a dense fluid contained in a sealed rigid tank. The U.S.A., whose researches into air speeds and altitudes have given the world some remarkable new devices, have recently internationally patented just such a flying suit: a double-walled suit which can be filled with air, or liquid, under pressure. But improvements in body resistance have also been effected by bandaging the legs and stomach, and by lowering the seat, raising the legs and adopting a crouching position. Greatest improvement, however, has resulted when the pilot is in the prone position. Turns and dives bring centrifugal forces to bear at right angles to the blood stream, in this position, and there is less abrupt displacement of blood. Much greater accelerations can be endured lying prone—face downwards, or upwards,—than in any other known position.

The Germans have produced a Heinkel plane which can reach 400 m.p.h. The British hold the world's land-speed record over a long course, when a Spitfire averaged 408·75 m.p.h. for 200 miles. The American "Thunderbolt" is the most powerful single-seat fighter in the world, and has easily topped the 400-m.p.h. mark. But all these planes carry heavy arms, ammunition, fuel, wind-resisting radio aerials and all the necessary equipment demanded by combat conditions. And so powerful have the engines which lift and accelerate these loads become, that when peace-time aviation comes back into its own, record speed levels will undoubtedly jump suddenly. Science cannot yet guarantee, however, that man's body will be able to withstand the stresses and strains which the metals that enclose him can easily resist.

Imagineering.—This is a fascinating word coined by the Aluminium Company of America. This new word admirably describes what is constantly taking place in scientific progress, writes *The Journal of Scientific Instruments*, 1942, p. 192. It seems to be especially applicable to the applications of physics to industry. Physicists in these times have usually to be also part-engineers. It has often been pointed out that physics is a subject requiring a good deal of imagination, and as was recently stated in *Nature*, the research physicist's 'real affinity is with the creative artist and the value to the community lies in the spark of originality which he brings with him into the world'. It is this combination of the creative artist with the more mundane engineer that seems to be so beautifully described as an 'imagineer'. It is to be hoped that imagineering which has come so much to the fore in recent years will develop under that name or any other that proves equally convenient and expressive.

SCIENCE NOTES AND NEWS

Fruit Flies of Poona.—Messrs. K. N. Trehan and S. V. Pingle from Agricultural College, Poona, write:—

Of the species of fruit flies recorded by us at Poona, *Dacus ferrugineus* F., *Dacus ferrugineus dorsalis* Hend., *Dacus zonatus* Saund., *Dacus cucurbitæ* Coq., and *Carpomia vesuviana* A.C., are responsible for considerable amount of damage; whereas *Dacus correctus* B., *Dacus diversus* Coq., *Mellesis* sp., and *Zeugodacus caudatus* are of minor importance since they do not cause any appreciable damage.

The following alternative host plants have been recorded by us for each species:—

I. *Dacus ferrugineus* F., bred from Mango (*Mangifera indica*), Guava (*Psidium guyava* L.), Citrus sp. Banana* (*Musa safrientum* L.), and Tomatoes (*Solanum lycopersicum* L.).

II. *Dacus ferrugineus dorsalis* Hend., bred from Mango, Guava and Tomatoes.

III. *Dacus zonatus*, bred from Mango, Guava, Chikoo (*Achrus sapota* L.), Tondli (*Cociinia indica* W. & A.), and water melon (*Citrullus vulgaris*).

IV. *Dacus cucurbitæ* Coq., bred from water melon, Khira (*Cucumis sativus* L.), snake gourd (*Trichosanthes anguina* L.), Dudhia (*Lagenaria vulgaris* Sc.), Ghosali (*Luffa ægyptiaca* Mill), Bitter gourd (*Momordica charantia* L.), Tomatoes and Tondli.

V. *Dacus correctus* B., bred from chikoo, citrus sp., Guava and Mango.

VI. *Carpomyia vesuviana* A.C., from Ber (*Ziziphus jujuba*).

The following is the relative investation of different species on one and the same fruit:—

	per cent.
1. Mango (*Mangifera indica* L.)	
(i) *Dacus ferrugineus* F. ..	52
(ii) *D. zonatus* S. ..	31
(iii) *D. correctus* B. ..	9
(iv) *D. ferrugineus dorsalis* H. ..	7
2. Guava (*Psidium guayava* L.)	
(i) *Dacus ferrugineus* F. ..	59
(ii) *D. zonatus* S. ..	28
(iii) *D. ferrugineus dorsalis* H. ..	12
3. Tondli (*Coccinia indica* W.A.)	
(i) *Dacus cucurbitæ* Coq. ..	25
(ii) *D. zonatus* S. ..	75

New Paper Fabric.—A significant aspect of the wartime search for substitutes is the use of paper to replace priority materials. One of the most interesting papers yet developed is Aqualized paper, a product of Brown Company, which may be used as a substitute for cloth and burlap. The name "Aqualized" was suggested by the paper's strength when wet, a feature not found in ordinary papers, which tend to lose strength and disintegrate in contact with water. By means of an exclusive process the individual cellulose fibres in the paper are effectively interlocked and fastened, giving an inherent wet strength all the way through the sheet that is independent of any coating or sizing on the surface of the paper. Some types of Aqualized paper are highly absorbent while others are made to repel water.

It is known that the Germans have already utilized paper for clothing, pup tents, sandbags, and camouflage. Aqualized paper, with its high wet strength, lends itself to this type of use and is already being impregnated or coated by converters for many war applications. Aqualized paper also fills an important place in the food field where its uses include potato bags, crate liners, loin wraps, and locker bags for frozen foods.—(*J. Applied Physics*, 1942, p. 788.)

The All-India Manufacturers' Organization.—Sir M. Visvesvaraya, President, and other members of the Working Committee of the All-India Manufacturers' Organisation, met Mr. M. S. A. Hydari, Secretary, Industries and Civil Supplies Department, Government of India, at the Office of the A.I.M.O. The Committee discussed with Mr. Hydari the following subjects:—

(1) Government's policy towards heavy and key industries to be established after the war and the preparation of plans for encouraging such developments.

(2) To extent of encouragement and active assistance Government were prepared to give now and in future to such industries and enterprises.

(3) The Committee wanted to know the post-war reconstruction plans of the Government with a view to co-ordinating its future programme with the plans of Government.

(4) The Committee sought information regarding the industries which had been started in the country since the commencement of the present war and the progress these industries had made. The Committee emphasised the need for Government to announce what protective measures they were prepared to take with a view to assisting the newly started industries.

(5) The Committee impressed upon the Government the necessity of correct compilation of essential statistics with a view to providing a proper standard for measuring the country's industrial progress and future possibilities.

This was followed by a discussion during which Mr. Hydari showed keen interest in the subjects under discussion and gave a sympathetic hearing to the suggestions made by the Committee.

A Mineral Research Institute.—In India, excellent research institutes have been founded to assist various industries such as agriculture, forestry, and jute. It is indeed paradoxical that India's mineral industry,

* First record of the fruit being invested with this pest.

which forms the real foundation for the country's industrial expansion, should have received no assistance of this nature. The scope for a Mineral Research Institute, controlled by practical men of experience, is enormous. Such an Institute would investigate many lines of enquiry, and would also help to co-ordinate the various problems of different branches of the industry. Improvements in treatment of one kind of mineral are commonly related to improvements in treatment of another. For this reason it would be preferable to include the Fuel Research Station, which has so long been advocated, within the Mineral Research Institute. Such an Institute would include also a Bureau of Mineral Information which would serve as a centre for the dissemination of information regarding minerals, and would issue statistics and bulletins; it would have a permanent staff whose duty it would be to make a study of Indian economic mineral resources. The Institute would be in close co-operation both with industry in general and with Government; its success would be largely dependent on the selection of its administrative staff from technical men of experience who must be left to work without political or official interference."
—(Extract from *Indian Mining*, by J. A. Dunn, 1943, p. 244, and reviewed on p. 211.)

Element No. 85.—*Science* (1943, 97, 112) reports press despatches from Bern, Switzerland, regarding the identification of element 85 as a disintegration product of radium. The work was done by Dr. Walter Minder and Dr. Alice Leigh-Smith, at the Radium Institute. They have collected sufficient amount and have succeeded in the photographic identification of the element. The name Anglo-helvetium is proposed in honour of England and Switzerland.

Central Jute Committee Monsoon Meeting: Important University Schemes.—The search for a suitable specification for a blue-dyed and polished jute twine to replace Italian hemp, for wool packs, in response to an enquiry from S. Africa, is engaging the attention of the Indian Central Jute Committee. This was revealed at the Monsoon meeting of the Committee held on July 15, under the presidency of Dr. W. Burns, C.I.E., acting Vice-Chairman of the Imperial Council of Agricultural Research. The problem of meeting the present shortage of steel hoops for binding cotton bales by finding the right type of jute ropes, in addition to the above, amongst others, has also been under investigation.

University schemes for (1) impregnating bleached jute fibre with a view to improving its textile qualities, (2) investigations on the chemical utilisation of jute waste and (3) X-Ray analysis of jute fibre with the particular view of exploring the possibilities of dyeing jute, by Profs. J. K. Chowdhury, B. C. Guha and M. N. Saha, respectively, were decided to be continued.

Prof. B. C. Kundu's scheme for the microscopic study of the growth and development of the jute fibre and Prof. B. C. Guha's scheme to study the micro-biology of retting were also decided to be continued.

A new scheme submitted by Prof. Sen Gupta of the Presidency College, Calcutta, for studying the effect of temperature, light and mineral nutrition on the growth of the jute plant was accepted in principle.

The Committee sanctioned a Jute Inspector to assist the Bengal Department of Agriculture for supervision of the Jute Propaganda Staff. Three additional posts of Agricultural Demonstrators were created to strengthen the jute propaganda work in Assam. An Orissa scheme for the multiplication of improved jute seed was sanctioned.

An important information revealed at the meeting was that while substitutes for jute were being developed during the war in many countries, U.S.A. topping the list, new uses for jute were being investigated in India alone.

SEISMOLOGICAL NOTES

Among the earthquake shocks recorded by the seismographs in the Colaba Observatory, Bombay, during the month of June 1943, there were four slight, two of moderate and two of great intensities. The details for those shocks are given in the following table:—

Date	Intensity of shock	Time of origin I.S.T.	Epicentral distance from Bombay	Co-ordinates of epicentre (tentative)	Depth of focus
		H. M.	(Miles)		(Miles)
2	Slight	09 25	1410	..	..
8	Moderate	05 50	2610	Lat. 2°·0 N., Long. 107°·5E.,	..
9	Great	03 13	2570	Lat. 1°·5 N., Long. 107°·5E.,	..
9	Great	09 36	2410	Lat. 2°·5 N., Long 105°·5 E.	75
13	Moderate	11 41	4590	..	..
15	Slight	17 40	4540	..	..
20*	Slight	22 03	2910	..	..
29	Slight	15 35	3730	..	95

* Extensive damage in the Turkish town of Adspazar has been reported. Sivas in Anatolia and the districts of Hendek and Arifiye have also been seriously affected.

MAGNETIC NOTES

Magnetic conditions during June 1943 were slightly more disturbed than in the previous month. There were 10 *quiet* days and 20 days of *slight* disturbance as against 20 quiet days and 10 days of slight disturbance during June 1942.

The quietest day during June 1943 was the 15th and the day of largest disturbance was the 8th.

The individual days during the month were classified as shown below.

Quiet days	Disturbed days
	Slight
1–5, 15–18, 30	6–14, 19–29

No magnetic storms occurred during the month of June in the years 1942 and 1943.

The mean character figure for the month of June 1943 was 0·67 as against 0·33 for June of last year.

M. V. SIVARAMAKRISHNAN.

ANNOUNCEMENTS

DR. P. K. KELKAR, M.A., PH.D., Lecturer in the Department of Electrical Technology, Indian Institute of Science, has been appointed Head of the Department of Electrical Engineering, V.J.T. Institute (Central Technical Institute), Bombay.

Art in Industry Exhibition.—It is announced that the 1944 Art in Industry Exhibition will be held in Calcutta in January of next year. Prize money will exceed Rs. 20,000 which is a record for any art exhibition in India. The Exhibition will contain a number of sections devoted to posters of recruiting themes and defence savings, and careless talk publicity will also feature prominently in the Exhibition. New features will be sections devoted to film scenarios, commercial photography and industrial design. Further announcements will be made shortly.

We acknowledge with thanks the receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 91, Nos. 4635, 4636 and 4639.

"Allahabad Farmer," Vol. 17, No. 3.

"Journal of the Indian Chemical Society," Vol. 20, No. 5.

"Indian Farming," Vol. 4, No. 2.

"Transactions of the Faraday Society," Vol. 39, Nos. 4 and 5.

"Indian Forester," Vol. 69, Nos. 5-7.

"Horticultural Abstracts," Vol. 13, No. 1.

"Central Board of Irrigation Bulletin," No. 38 (June 1943).

"Bulletin of the Central Jute Committee," Vol. 6, No. 3.

"The Journal of the Indian Mathematical Society," Vol. 6, No. 4.

"The Mathematics Student," Vol. 10, No. 3.

"Indian Medical Gazette," Vol. 78, No. 6.

"Bulletin of the American Meteorological Society," Vol. 23, No. 8.

"The Journal of the Bombay Natural History Society," Vol. 43, No. 4.

"Nature," Vol. 151, Nos. 3822, 3824-26.

"Journal of Nutrition," Vol. 25, No. 2.

"American Museum of Natural History," Vol. 50, No. 5; and Vol. 51, No. 3.

"Indian Journal of Physics," Vol. 16, Pt. 6; Vol. 17, Pt. 1.

"Science," Vol. 96, Nos. 2499, 2501 and 2503.

"Science and Culture," Vol. 8, Nos. 11 and 12; and Vol. 9, No. 1.

"Journal of Scientific and Industrial Research," Vol. 1, No. 3.

"Monthly Science News," Nos. 17-20.

"Sky," Vol. 2, Nos. 2, 4 and 5.

"Indian Trade Journal," Vol. 149, Nos. 1928-31; and Vol. 150, No. 1932.

"The Indian Journal of Veterinary Science and Animal Husbandry," Vol. 13, Pt. 1.

BOOKS

Soil and Plant Analysis. By C. S. Piper. (The University of Adelaide, Adelaide, South Australia), 1942. Pp. xiv + 368. Price 15/- (Australian Currency).

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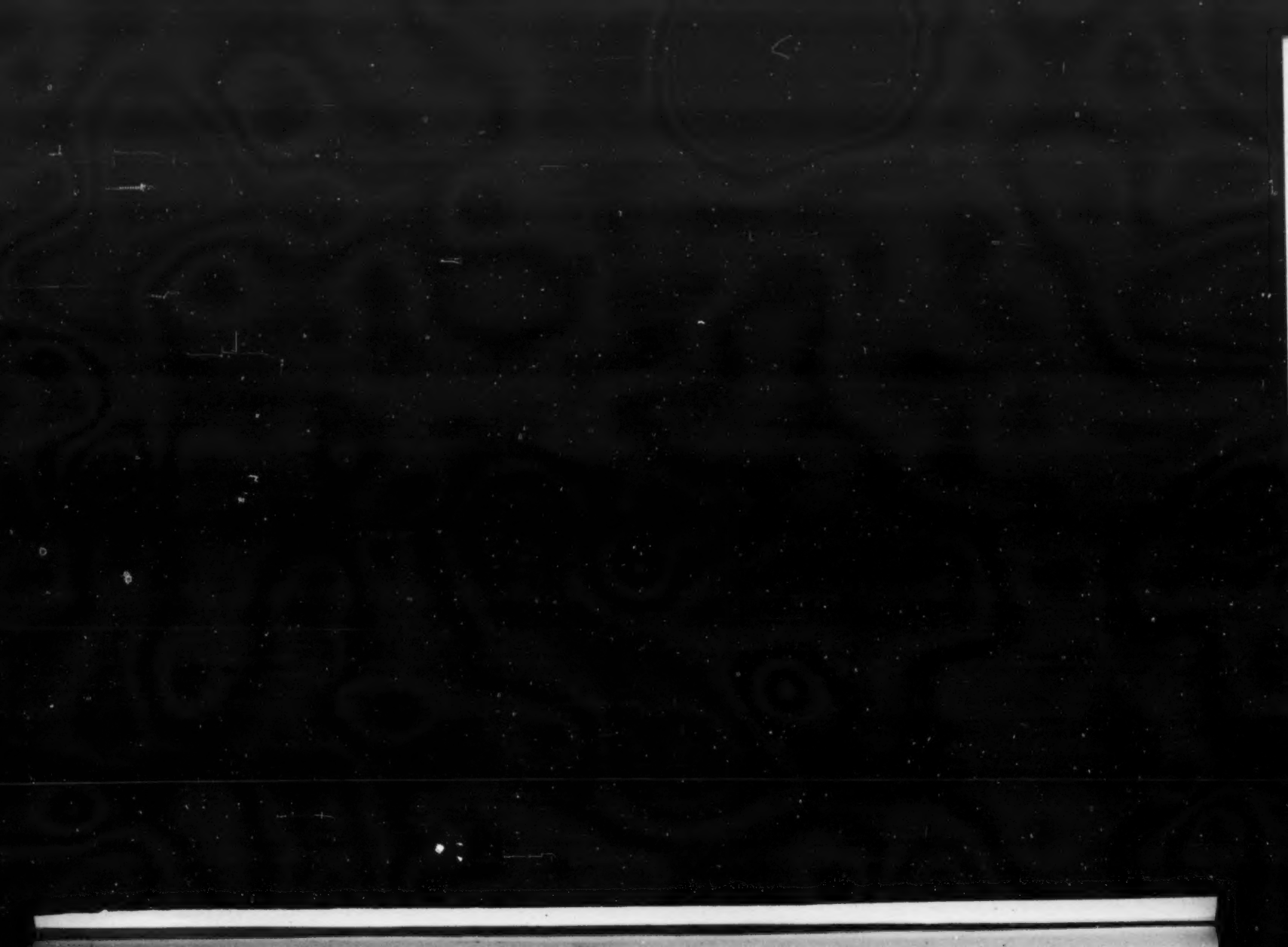
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